QUANTUM MECHANICS III

PHYS 518

Problem Set # 2

Distributed: Oct. 7, 2013

Due: Oct. 14, 2013

1. A rectangular barrier has width 8Å and energy 5 eV.

a. Compute the transition probability $T(E)$ for an electron incident on this barrier *analytically*. Plot $T(E)$ in the range $0 < E < 20$ eV.

b. Develop a code that computes $T(E)$ for an electron incident on a potential containing an arbitrary number of piecewise constant potential regions. Use this code to compute $T(E)$ for the barrier described above. Compare these results with the results that you obtained analytically and plotted in part **a.**

c. Do you have some confidence in your code?

2. An electron is incident on an "attracting barrier" of width 8 Å and energy -5 eV. Repeat the steps of Problem # 1 for this barrier in the range $0 < E < 20$ eV.

3. Two identical scattering barriers of width 4 Å and height 5 eV are spaced 6Å apart.

a. Compute $T(E)$ in the energy range $0 < E < 20$ eV.

b. Do you think you have found all the transmission resonances? Why? How can you be sure?

4. Compare the phase shift experienced by an electron in two arms of an interferometer. In one arm there is an attracting potential barrier of depth $V < 0$ eV and width 8Å and in the other arm there is no attracting/repelling potential. How can you measure the phase shift as a function of fixed incident energy E and varying potential depth V, $-5 < V < 0$ eV?